DCODE PROJECT

Decision Making Constructs in a Distributed Environment

Improving Collaboration in Command and Control Environments: Creating and Exchanging Iconic Tags of Key Information

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2005		**00-00-2005 to 00-00-2005**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Improving Collaboration in Command and Control Environments: Creating and Exchanging Iconic Tags of Key Information	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Space and Naval Warfare Systems Center San Diego,53560 Hull Street,San Diego,CA,92152-5001**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

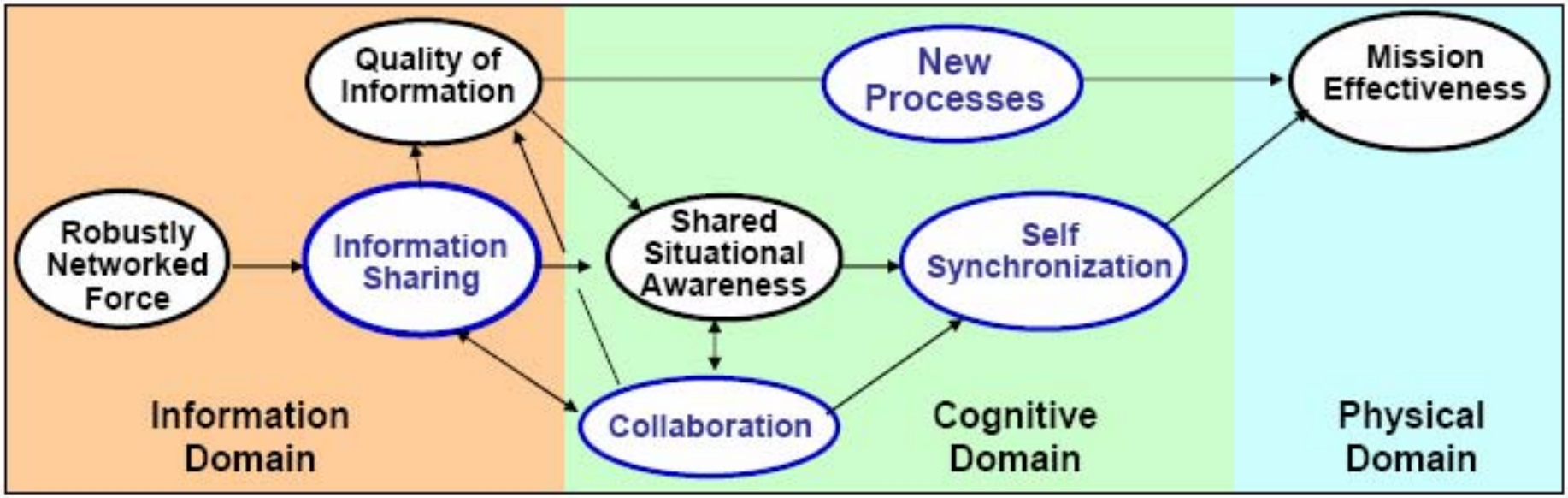
15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**		**33**	

Tenets of Network Centric Warfare

...The New Value Chain

- A robustly networked force improves information sharing
- Information sharing and collaboration enhances the quality of information and shared situational awareness
- Shared situational awareness enables collaboration and self synchronization, and enhances sustainability and speed of command
- These in turn dramatically increase mission effectiveness



DCODE Objectives

- The DCODE objectives are to:
  - improve the ability of both individual and distributed group decision makers to **evaluate, share, and integrate decision-relevant information items** and
  - to improve decision time by **reducing the time and effort devoted to conflict resolution and consensus building** in reaching an overall group decision

DCODE

Decision Making Application Areas

- Information Fusion, Analysis and Situation Assessment
- Option Generation/Selection
- Course of Action (COA) Recommendations
- Consensus Building

Multiple Options, Multiple Information Items About Each Option

Two Problem Areas Addressed



The most important, high impact items

#1 How do we improve the process of getting to here…

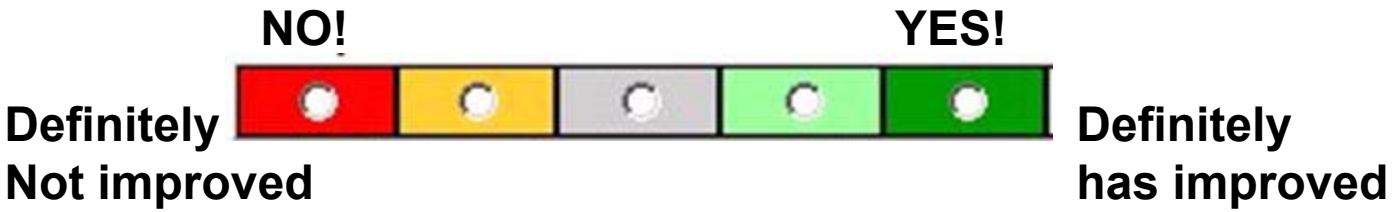
#2 How do we form an aggregate opinion from conflicting inputs.

1000's of possible decision relevant information items….

Sample Decision Making Task

- We have spent a lot of money over the last two years on improving airport security.

- <u>Has</u> Airport Security significantly improved?
  - Review reports and assign an overall effect/impact score to the results:



You search and retain 10 reports

Vulnerabilities an
Improvements for

What GAO Found

Numerous government and indus
the air cargo system. These vuln
of some air carriers and freight f
freight at various handoffs that o
shipper to the point when it is lo
weaknesses in this program coul

FAA or the Transportation Secur
responsibility for ensuring air ca
key recommendations and mand
since 1990 by numerous governm
the air cargo industry developed

Airport Security Gets Another 'F'

LOS ANGELES, Sept. 3, 2002

VIDEO
Screeners Flunk CBS Test

(Photo: CBS/AP)

(CBS) In January and February, C
went undercover to test security
American airports. We took lead-
bags, which block X-rays, throug
checkpoints.

Steve Elson, who used to test ch
security for the Federal Aviation
Administration, helped us with o

"When the bag goes through the
there's a big black blob," says El
"They're impossible to miss and
just continually let it go."

Screeners could not clearly see
in our carry-ons and should have

FLUTE

Screeners in Atlanta and
Washington
didn't check
bags six mo
again they
this time.

US airport security under fire

Security on US domestic flights i

By BBC News Online's Sh
Matthews

US airline security has suff
breach in history.

At least four separate tea
boarded planes and hijack
hours of each other.

But security experts say
the terrorists had been
presented with virtually
an open goal.

Security on US domestic
flights is so relaxed that

GAO
Highlights

Highlights of GAO-03-1173, a report to the Chairman, Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

Passenger screening is critical to the security of our nation's aviation system, particularly in the aftermath of the September 11, 2001, terrorist attacks. The Transportation Security Administration (TSA) is tasked with securing all modes of transportation, including the screening of airline passengers. TSA has met numerous requirements in this regard, such as deploying more than 50,000 federal screeners at over 440 commercial airports nationwide. To determine whether TSA's passenger screening program is achieving its intended results, GAO is conducting an ongoing evaluation of TSA's effo

September 24, 2003

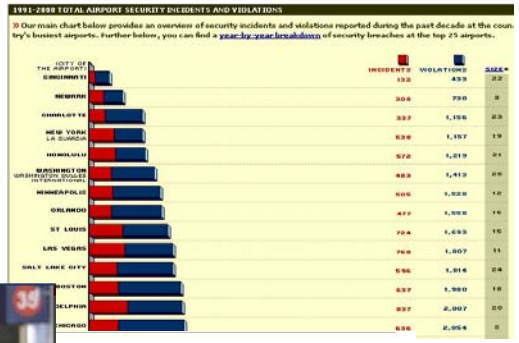
AIRPORT PASSENGER SCREENING

Preliminary Observations on Progress Made and Challenges Remaining

What GAO Found

The Transportation Security Administration (TSA) was tasked with the tremendous challenge of building a large federal agency responsible for securing all modes of transportation, while simultaneously meeting ambitious deadlines to enhance the security of the nation's aviation system. Although TSA has made significant progress related to its passenger screening program, challenges remain.

TSA recognized that ongoing training of screeners on a frequent basis, and effective supervisory training, is critical to maintaining and enhancing skills. However, TSA has not fully developed or deployed recurrent or supervisory training programs. Although TSA has not yet deployed these programs, it has taken steps in establishing recurrent and supervisory training, including developing six recurrent training modules that will soon be developed to all



nt

rport Security Issues

of 11 September 2001 has made security an extremely high priority
ound the world. Although there has been an increase in the level
the advice on this page should provide an overview of what to
g through many of the world's airports.

Guest Comment

On NRO

Security, Smith's Way

The cyber model.

By James D. Miller, assistant professor of economics, Smith College
October 30, 2001 9:45 a.m.

Unleash the marketplace to strengthen airport security. The socialistic solution of federalizing airport-security workers will deny us the creativity we need to fight terrorists. Only by utilizing the constant competition that the free market provides can we protect America's skies.

Computer networks have to endure incessant attacks from hackers. Network providers have to continually strengthen their defenses to ward off new types of assaults. Hackers have consequently increased computer security and have made the U.S. more resistant to terrorist cyber-attacks. Computer security is not provided by the government, but rather by a marketplace that punishes any firm that can't protect its electronic assets. America's airplanes should be protected by a similar free market approach.

anadian

Illustration by Jameson Simpson

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SPECIAL REPORT

THE STERILE AIRPORT

Near-total airport security is possible. Technologies are in sight to seal the leaks, spot the bad guys, find the bombs.

by Dan Tynan

1 | 2 | 3 | 4

AIRPORT SECURITY FOR THE 9/11 AGE

Recent dummy-weapon tests at airports show it's still possible to get guns through security. here's how a super-secure airport would work.

We asked Isotec Inc., a Denver-based security systems design firm, to help us engineer an airport that would target terrorists without gumming up passenger traffic. We also sought input from CompuDyne Corp., Viisage Technology, General Defense Systems, and other companies that make and install security equipment. In this exercise, money was no object; safety was our only concern.

We set a target date of five years from now. But much of the technology is available, or will be very soon. The goal: Every person, every bag, and all supplies and equipment in an airport will be tagged, tracked, and instantly locatable.

1. CHECK-IN AND SECURE ID

Initial safeguards appear a mile outside the airport. Scanners at tollbooth-like structures along access roads aim their laser scanners at

Background:

- Research has shown that in a group decision making environment, members usually discount any uniquely held information that gets shared with the group.*
- This shared, uniquely held information typically does **not** impact the final decision.
  - "You can lead a group to information, but you can't make it think."
    - **Why is this true?**

*Stasser et al

Hypothesis

- (1) A group member already has a high cognitive burden in processing the information he has found.
- (2) Shared information from other members usually arrives in an unprocessed form:
  - "Here's a relevant report you should read"
- (3) The new information is not integrated into the decision process because it causes too great of a cognitive burden.

Challenges

- Improve the quality of group decision making by
  - (1) enhancing the ability of each participant to assess/evaluate their pool of disparate information findings
  - (2) simplifying the process by which participants share uniquely held information
  - (3) improving the process for integrating this shared information into the on-going decision process and
  - (4) developing information "drill down" capabilities so that participants can quickly focus on the differing subjective assessments that are causing lack of decision consensus.

Approach

- Exchange processed, subjective assessment information:
  - "Read this report" vs.
  - "The originator of this report has high credibility, the information is timely, backed up by facts, is of high importance and has a strong negative effect on use of option C"
    - **How do we encapsulate these subjective assessments?**

Subjective conclusions from each of the reports

…but other subjective estimates have also been made..

SPAWAR Systems Center San Diego

Difficult Task!

NO! YES!

Highly Reliable Source

Old Data

Good documentation

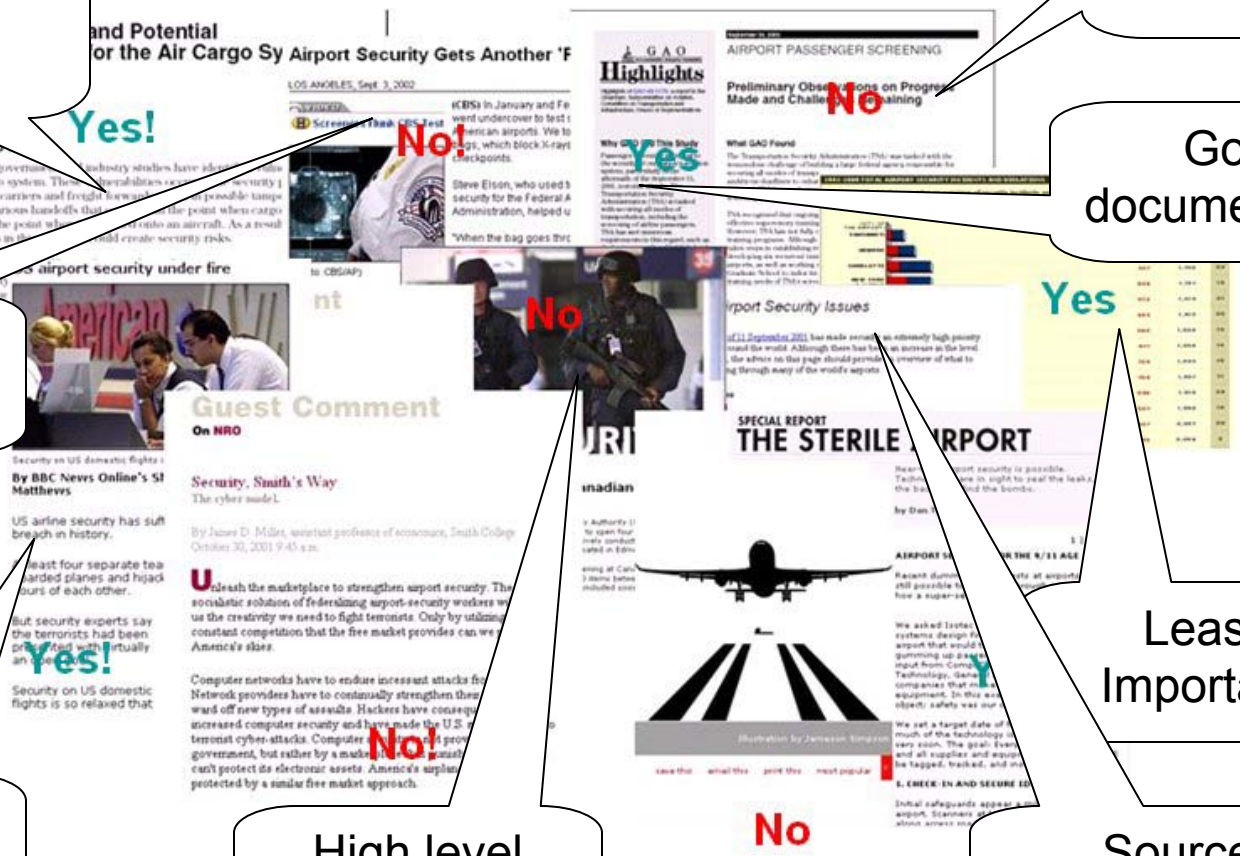
Very recent info.

Least Important

Most Important

High level of uncertainty

Source Credibility?



What are the key Essential Elements that need to be Abstracted from an Information Item?

- Where does it Fit?
  - i.e. which decision criteria/factor (e.g. cost, risk, etc.)?
- How good is the information Quality?
  - What is the Credibility of the source?
  - How Timely is this information?
  - How much Confidence do I have in the information?
- What is the Effect/impact of the information on the criterion?
  - **Positive or Negative**?
  - **Strong or Weak?**
- What is the Importance of this item relative to other items?

DCODE Solution: Convert IMPLICIT subjective estimates into EXPLICIT estimates.

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Illustration by Jameson Simpson

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1. CHECK-IN AND SECURE ID

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Credibility?

Effect/Impact?

Importance?

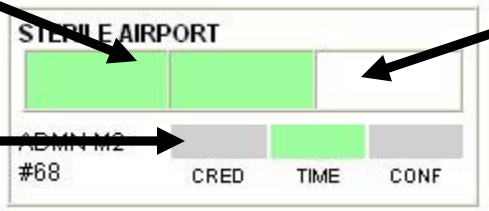
Timeliness?

Encapsulate the scores into an icon (called an Information Object, IOB) that displays information quality, impact and importance

Effect/Impact: Color

Quality of information

Information Importance: Size of color bar (1, 2 or 3 sections filled)



IOB

DCODE Approach

- Improve the ability of both individual and group decision makers to:
  - Abstract
  - Encapsulate
  - Assess
  - Share

…all decision relevant information items.

Information Tagging

The EWall program is a highly efficient method of displaying, organizing and sorting diverse information.

Critical concept is translating each information item into an EWall card, also called an Information Object (IOB)

DCODE

DCODE enhances EWall capabilities by adding the ability to:

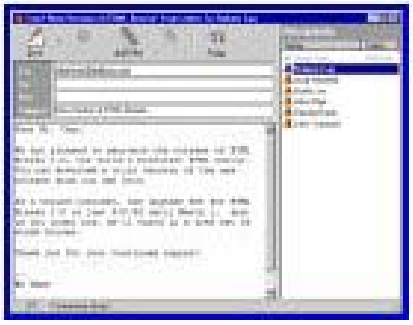
assess, store and display a user's cognitive interpretation of the information,

specifically, the impact, importance and quality of any decision-relevant information item

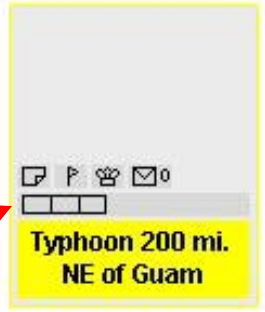
EWall & DCODE

•**EWall:** Architecture for the Abstraction, Encapsulation and Sharing of information.

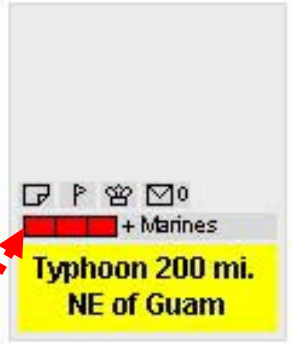
Original Document



EWall Icon

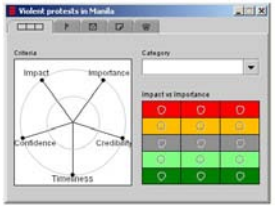


(1.5 x 2.0 in.)



Information Object (IOB)

DCODE: Process for capturing and displaying the cognitive **assessments** of each information item ("what does this mean?")



The DCODE assessment template

The DCODE assessment "bar"

DCODE/EWALL Example

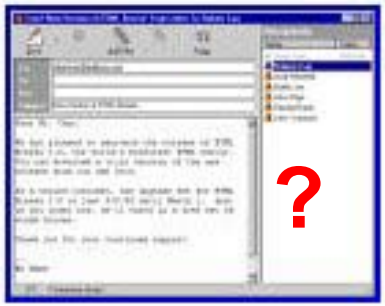
Scenario: Rescue 3 Red Cross workers from the Island of Drapo (insurrections)

Options: Use SEALs, Marines or the Army

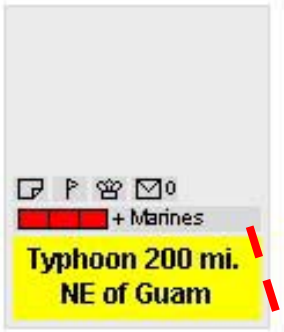
Analysts: Baker, Jones, Smith

This is Jones, looking at the viability of the Seals option

Information Abstraction, Encapsulation and Assessment



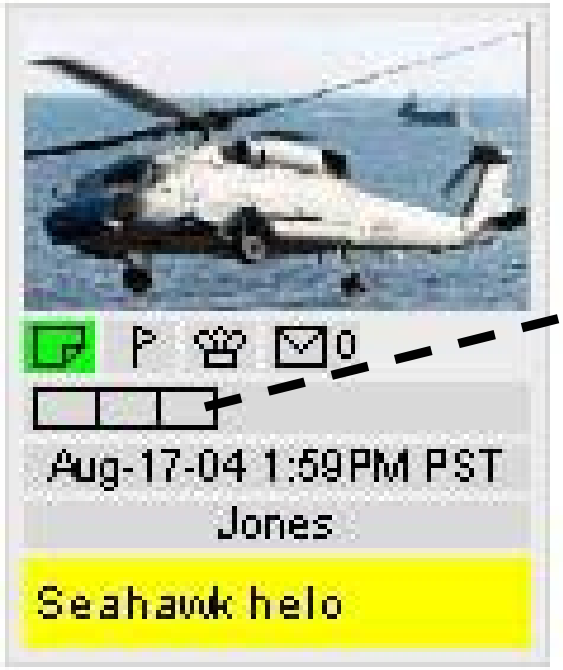
"Typhoon has serious and very negative effect on using the Seals"

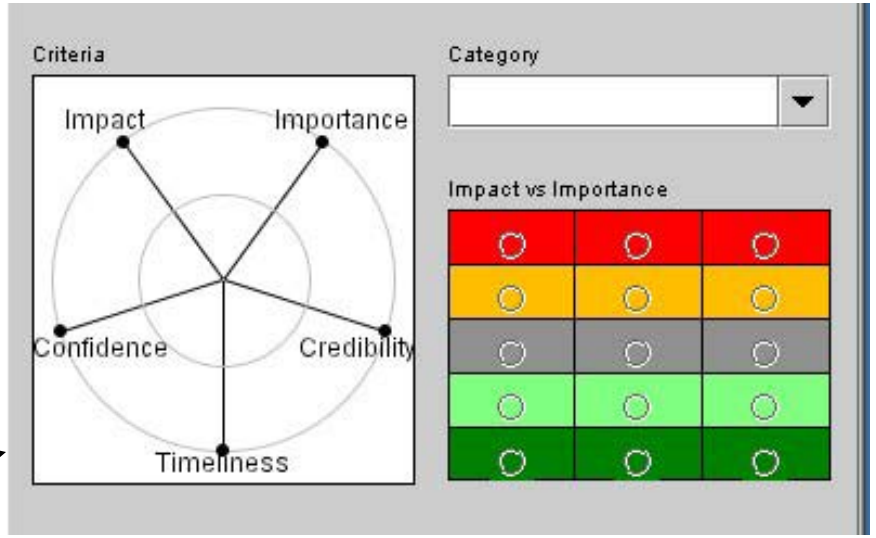


Perform DCODE assmt. on IOBs that are retained for use/sharing in final decision making. (Assessment)

Convert candidates from original format into EWall IOBs (Abstraction, Encapsulation)

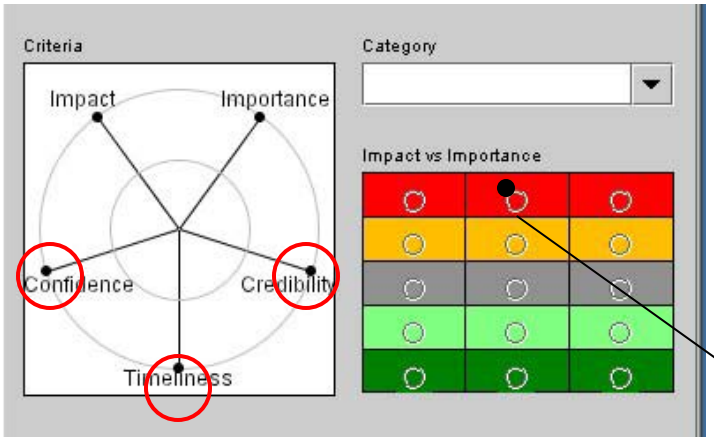
DCODE Assessment





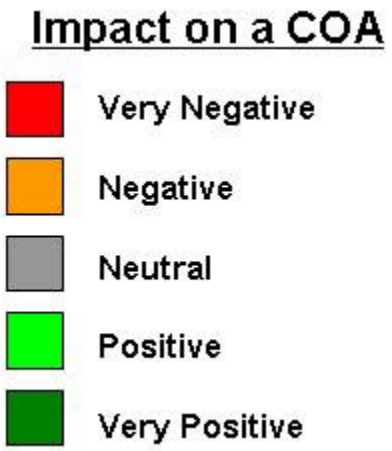
Cognitive Assessment

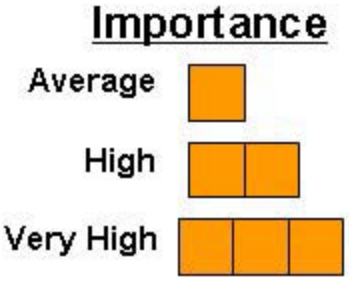
The subjective assessments of each IOB are converted into size and color coded icons.



3 Slider-bar adjustments for Information Quality

Very negative impact on SEALs, High Importance





IOB Designs

IOB design can be tailored to meet specific decision making requirements.

Picture/text

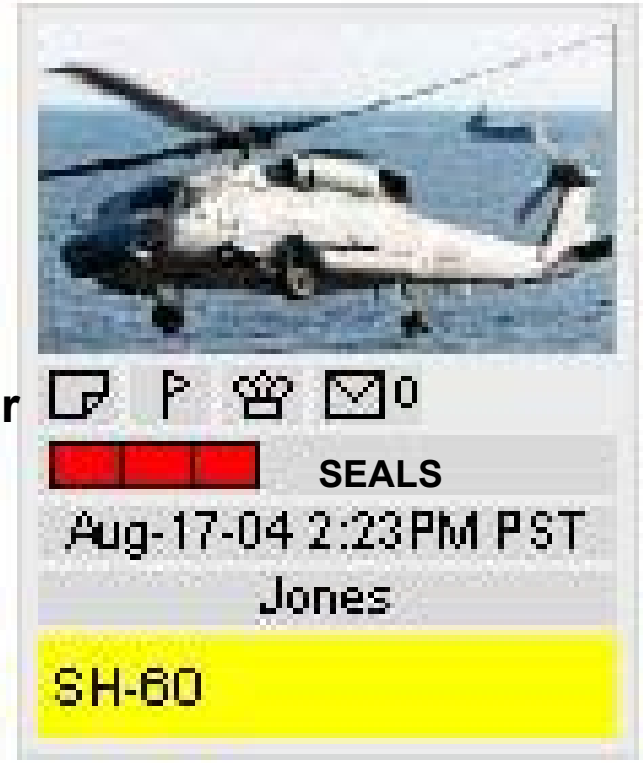
Information Bar

Assessment

Date

Author

Keyword



Grouped/Sorted DCODE IOBs

Decision Team

Option A Option B Option C

Analyst(s)

Evaluated (DCODE) IOBs

"…retain/use these items.."

10's

Data Collector(s)

Create EWall IOBs

100's

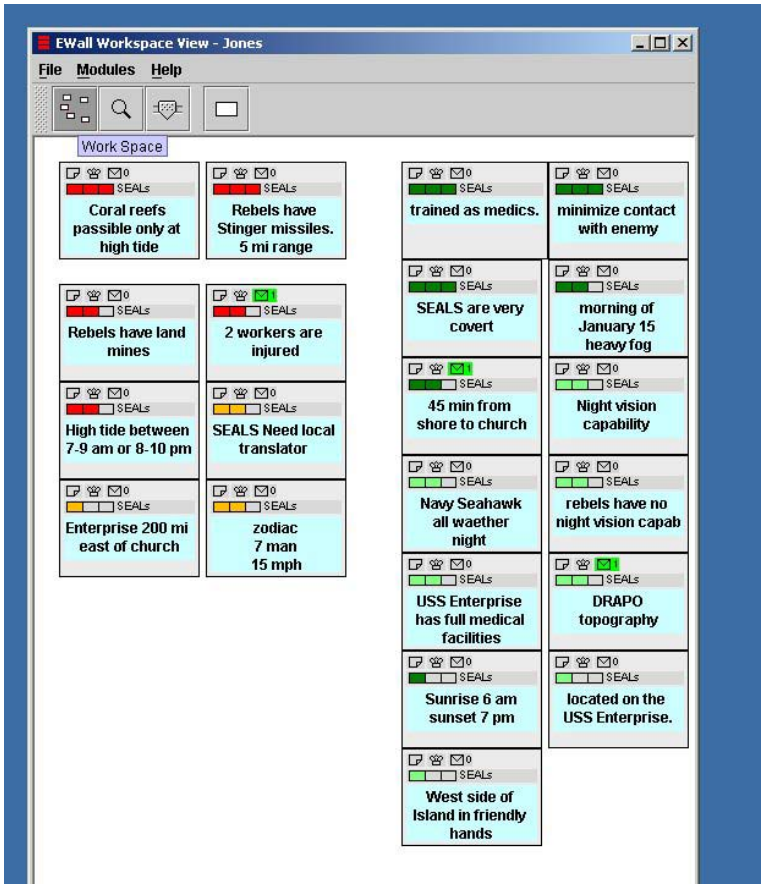
Agents, Bots, Search Engines

"…may be of interest.."

1000's of possible relevant information sources

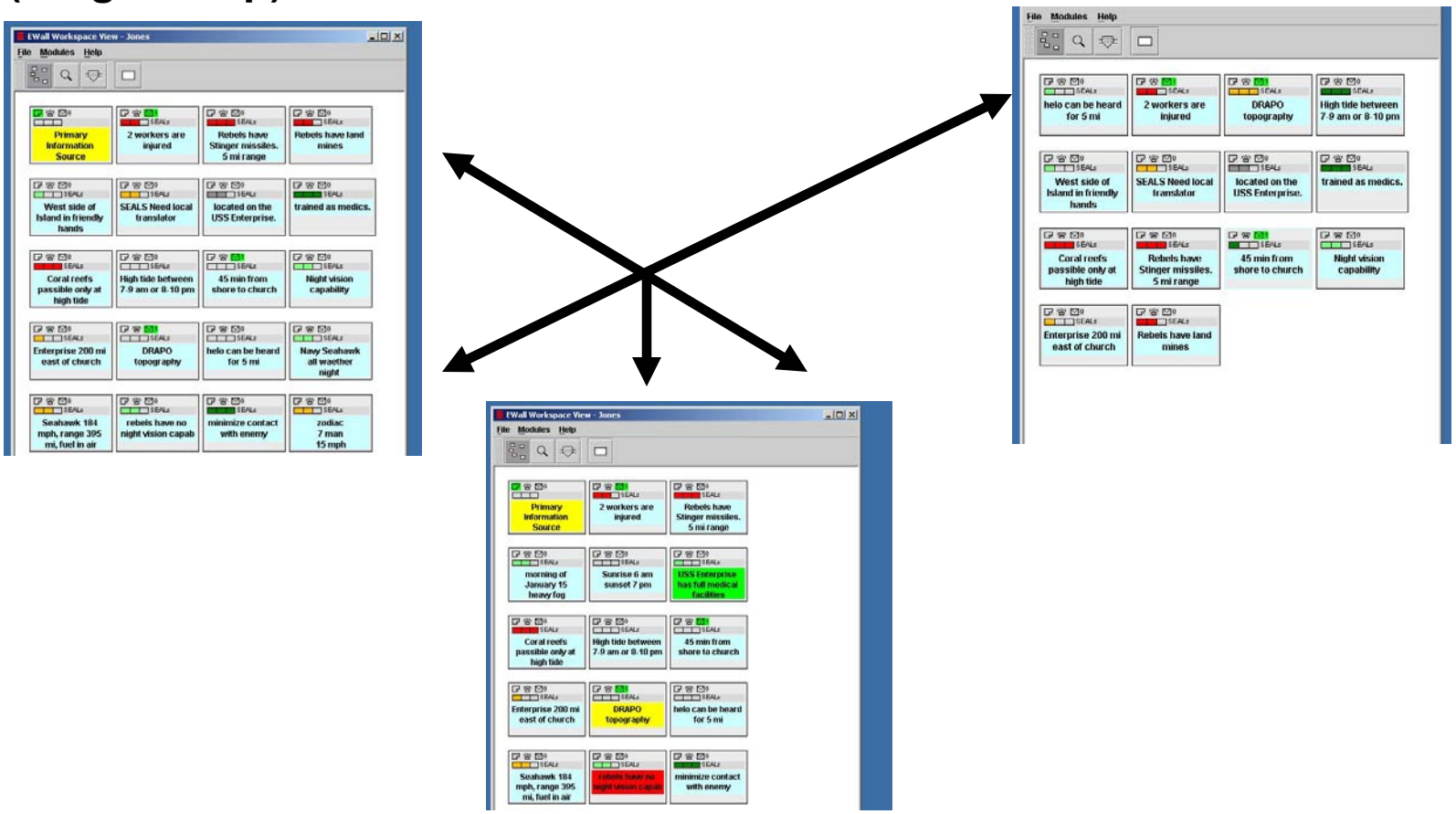
IOB Sorting

Sorting/organizing of completed IOBs are used to evaluate each COA



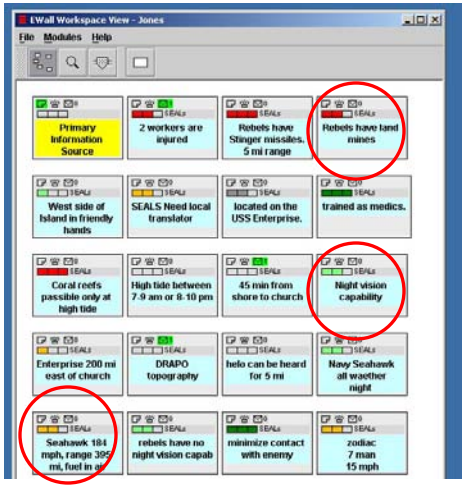
IOB Exchange

Group participants can exchange, incorporate or modify each other's IOBs (drag & drop)



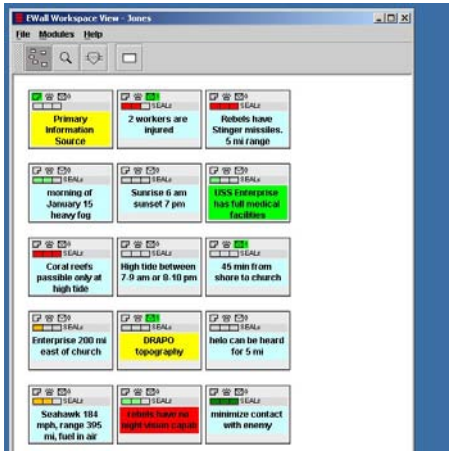
Conflict Resolution/ Consensus Building

Exchange/evaluation of the IOB pool permits focused discussion on differing COA selections and results in quicker/better group decisions.



"Marines"

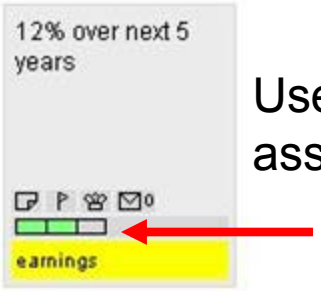
"SEALs"



"SEALs"

CSU Experiment

- 36 Subjects at Colorado State
- Rank Order 3 companies in terms of a good stock investment
  - Standardized test used in other studies
- Compare decision performance of subjects who used IOB subjective assessment color bar (Effect and Importance) vs. those that did not.



Used Subjective assessment

Did not use Subjective assessment

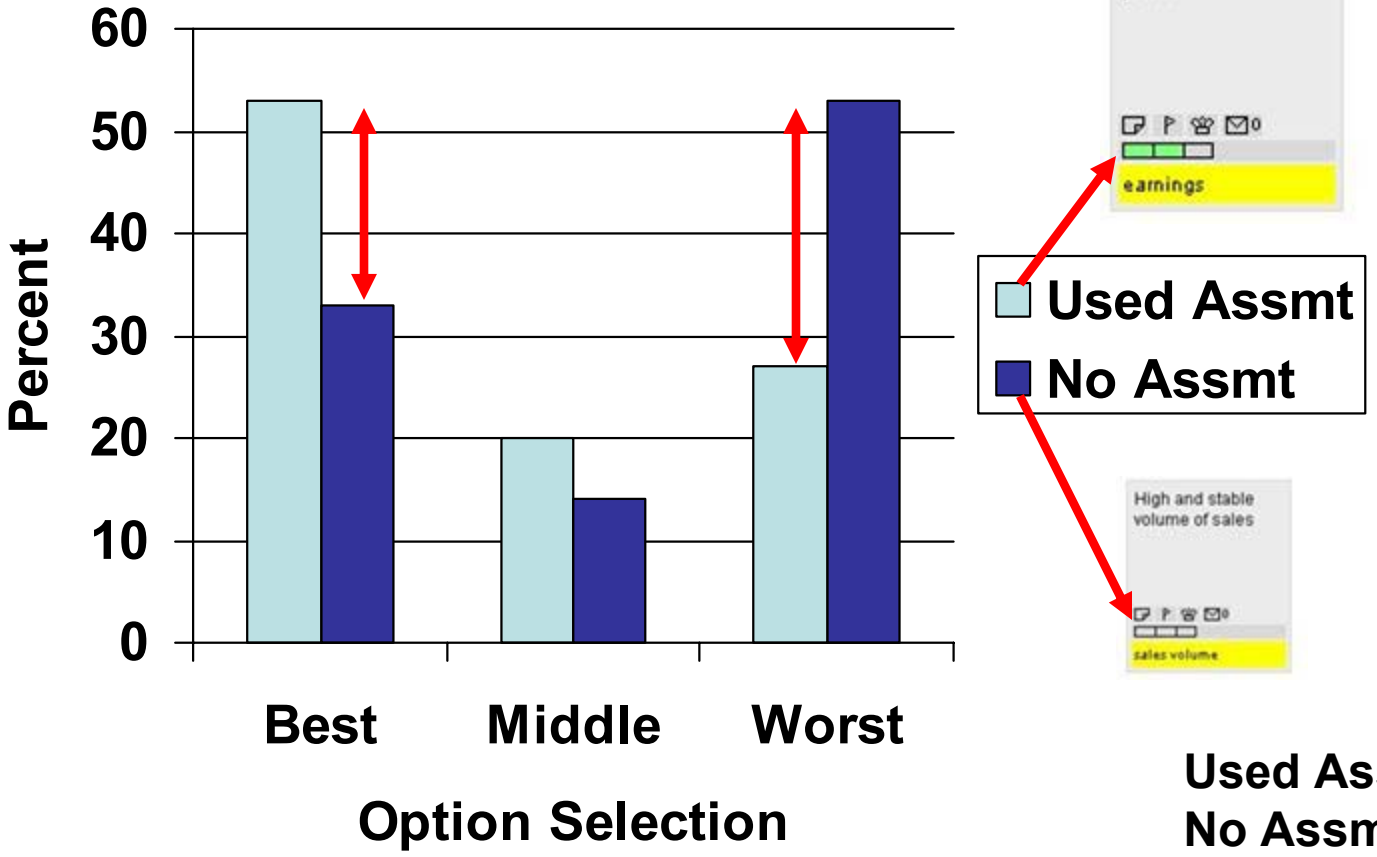
Task

- Select the best company to invest in out of a group of three.
- Read a report about each company
  - Profits, work force, CEO, new markets, etc.
- Create IOBs about each company
  - Watched AVI videos on how to create and use IOBs and the DCODE options.
  - Creation, layout, contents, DCODE options totally under subjects control.
- Make a final Rank Ordering of the 3 companies.
- $ incentive for best performance

Overview

- 36 subjects participated
  - 14 Females
  - 22 Males
- 15 of the subjects used the DCODE color bar option

Use of Subjective Assessments



Used Assmt. N=15
No Assmt. N=21

Experiment at Colorado State

DCODE
Concept of Operations:

DCODE works with MIT's Electronic Card Wall (Ewall) Program, which provides a strong framework for the abstraction, encapsulation and sharing of of decision relevant information items.

DCODE expands/enhances this capability by capturing, displaying and sharing the **subjective assessments** a team member attaches to each item. An Ewall card, with the attached DCODE assessments is referred to as an **Information Object (IOB)**

IOBs compactly display physical **data** (reference link, originator, abstract, time tag, etc.) as well as **meta data** (credibility of source, importance, option impacted, timeliness, etc). This combination of information helps individuals and teams consider the full range of pooled assessments available on a topic, and to balance the diversity of viewpoints.

The critical feature of DCODE is its ability to capture, display and share these subjective assessments.